# On the Trilobite Genus *Celmus* Angelin, 1854

By

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ABSTRACT.—The trilobite species *Celmus granulatus* ANGELIN, 1854 is redescribed. Following FR. SCHMIDT (1907) the genus *Crotalurus* VOLBORTH, 1858, is considered as a junior subjective synonym of *Celmus* ANGELIN, 1854. A new family *Celmidae* is erected with *Celmus* as the sole representative. The terms *eu-ptychopariid* and *steno-ptychopariid* type of ventral cephalic sutures are introduced to denote a broad and a narrow rostral shield, respectively, separated by sutures. A new subfamily *Mesotaphrasinae* is erected for certain genera with levisellid type of facial suture including *Mesotaphrasis*, *Chomatopyge* and, provisionally, *Clelandia*.

In 1854 ANGELIN (pp. 23–24, Pl. XVII, fig. 8–8 a) erected a new trilobite genus and species named *Celmus granulatus* derived from *strata regionis* C, Skarpåsen, Östergötland. He illustrated and briefly described the cephalon and thorax whereas the pygidium was apparently unknown to him. The genus was left unplaced in family.

In 1858 VOLBORTH (pp. 126–133, Pl. XII, fig. 1–5) described a trilobite from the Lower Ordovician limestones at Pavlovsk, Ingermanland, believing it to represent a new genus and species which he named *Crotalurus barrandei*. His thorough description comprised the whole carapace with the exception of the hypostoma. The genus was left unplaced in family. As far as can be judged from the references in his paper the monograph of Angelin (1854) had not been available to him.

The genus *Crotalurus* was included in the family no. XV (*Cheiruridae*) by BARRANDE (1872, p. XXX). FR. SCHMIDT (1881, pp. 119–120) excluded it, however, from the *Cheiruridae* on account of its opisthoparian facial suture but left open the taxonomical position of this genus. Subsequently FR. SCHMIDT (1907, pp. 15–16, Pl. I, figs. 9, 10, 11) published a redescription of VOLBORTH's material of *Crotalurus barrandei* VOLB. From a study of photographs of the type specimens of *Celmus granulatus* he concluded that *Celmus* and *Crotalurus* are subjective synonyms, and that also the type species of these genera appear to be synonymous. Nevertheless, he continued to use VOLBORTH's name for the genus and species pointing out that VOLBORTH's description was more complete, and that the generic name *Crotalurus* had been more widely used in the literature than *Celmus*. In this paper

FR. SCHMIDT again included *Crotalurus* tentatively in *Cheiruridae* chiefly because no better place for this genus could be found (cf. also STUBBLEFIELD 1936, p. 416). WEBER (1932, pp. 122–123) included *Crotalurus* in *Proetidae* on account of the general resemblance of the glabella in *Crotalurus* and *Cyphaspis*. He also described the new species *Crotalurus? strigatus* from Tamdy River, Karatau Range, but pointed out in a footnote (p. 122, footnote 1) that this species no doubt belongs to *Glaphurina* erected by ULRICH (1930) in a paper which became accessible to WEBER first after his manuscript had already been submitted for publication. ÖPIK (1937, p. 92) suggested that *Celmus* (incl. *Crotalurus*) should probably be placed into a new opisthoparian family. Recently TJERNVIK (1952, pp. 61, 64) recorded *Crotalurus* n. sp. from the Lower *Planilimbata* limestone of Närke, and BOHLIN (1955, p. 115) *Celmus granulatus* from the *Raniceps* limestone of Öland, and (1955, pp. 127-128) *Celmus* aff. *granulatus* from the *Gigas* limestone of Öland.

In connection with the preparation of the trilobite part of the Treatise of Invertebrate Paleontology it appeared necessary to settle the taxonomic position of the genus *Celmus*. For this purpose the present writer undertook a study of all available material of *Celmus* from Sweden, including the cotypes of ANGELIN. In the present paper a redescription of the type species of *Celmus* is given together with a discussion on the taxonomic position of the genus. The pygidium, previously unknown from Sweden, and the hypostoma, hitherto not known in this genus, are also included in the description.

The material studied belongs to the following museums: State Museum of the Natural History (Naturhistoriska Riksmuseet) in Stockholm (RM), Museum of the Geological Survey of Sweden (SGU), and Museum of the Palaeontological Institution of the Univ. of Uppsala (UM).

## Remarks on the Terminology

In the literature on trilobites written in English language the middle region of thorax and pygidium is frequently termed "axis", and the furrows which limit this region laterally—the "axial furrows". These terms have been used by SALTER (1864, etc.) who was followed in this respect by WARBURG (1925) in her critical revision of the terminology of the trilobite carapace. The fact that WARBURG herself in her later papers (e.g. 1939, p. 6) found these terms to be inadequate and replaced them by the old terms "rachis" and "dorsal furrow" is, however, less known. The word "axis" means a line and its use for an area of a body is not quite happy. The term "axial lobe" used by WALCOTT (1908 and later papers) is a more suitable term if the use of the word "axis" for the middle region of the trilobite carapace is preferred. For this region DALMAN (1827) had introduced the term "*rhachis*" (in English usually "rachis") and as this paper of DALMAN may be regarded as the foundation of the scientific terminology of the

trilobite carapace, his terms may reasonably be retained. The term "axial furrow" in the sence of "*sulcus dorsalis*" of DALMAN (1827) is, however, from the point of view of zoological terminology, entirely misleading and ought to be dropped. DALMAN's term "dorsal furrow" has been widely accepted (e.g. BARRANDE 1852 ["*sillon dorsaux*"], RICHTER 1912 ["*Rückenfurche*"], WARBURG 1939, Howell *et al.* 1947, to mention only a few outstanding discussions on the terminology of the trilobite carapace), and is used also in the present paper.

For brevity as well as clarity symbols have been used in the present paper to denote the lateral glabellar lobes and furrows. The present writer completely agrees with WARBURG (1939, p. 5) in considering unnatural the numbering of glabellar furrows and lobes from behind forwards. On the other hand, as pointed out by several writers (most recently by WHITTINGTON & EVITT 1954, p. 13), this method of numbering provides at present the only possibility assigning the same figures to homologous furrows and lobes. For purely practical reasons, therefore, the furrows and lobes are, following RICHTER & RICHTER (1940, p. 17, fig. 3 A), numbered from back to front. The lobes are lettered "L" (after *lobus*) and the furrows "S" (after *sulcus*). In the terminology used previously by BARRANDE (1852, Pl. 1, fig. 1), RICHTER & RICHTER (1926, p. 126, fig. 14), and the present writer (1954, p. 551, fig. 5) the basal (posterior) lobe (furrow) corresponds to L1 (S1), the middle lobe (furrow) to L2 (S2), and the anterior lobe (furrow) to L3 (S3). These figures in combination with letters L and S ought to be used only if the method of numbering is that applied in the present paper, i.e. from back to front. In this case the letters "*p*" (= posterior) or "*a*" (= anterior) after the figures giving the direction of numbering, as suggested by WARBURG (1939, p. 5), are superfluous.

The terminology of the different types of ventral cephalic sutures used in the present paper corresponds to that of RASETTI (1952). The type with a rostral shield separated by sutures is accordingly called the ptychopariid type. Within this type it is, however, advantageous to distinguish two subtypes. In the present paper the genera with a broad rostral shield are spoken of as the eu-ptychopariid type (as in *Ptychopariidae*, *Illaenidae*, *Scutellidae*, *Cheiruridae* etc.). To the genera with a narrow rostral plate (as in *Encrinuridae*, *Celmus*, *Catillicephala*, *Hystricuridae*, *Dimeropyge*, *Dimeropygiella*, certain *Bathyuridae* etc.) the term steno-ptychopariid is applied. The type of ventral cephalic sutures where the anterior branches of the facial suture are fused, and no median suture is developed (as in *Phacopidae*, *Nileidae*, *Levisella*, *Glaphurus*, *Mesotaphrasis* etc.), is called, following RASETTI, the levisellid type, and, when a median suture is developed, the asaphid type. The different types of ventral cephalic sutures referred to in this paper are illustrated in fig. 1.

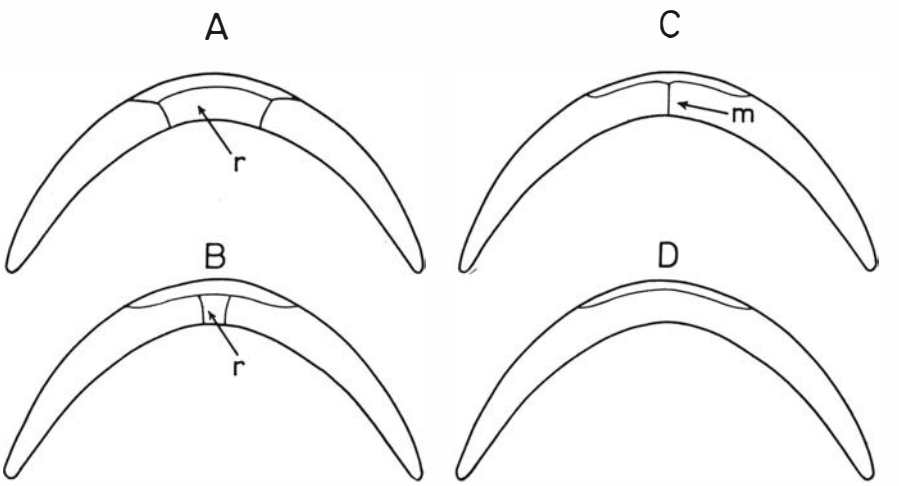


Fig. 1. Schematic illustrations of the different types of ventral cephalic sutures referred to in the present paper. A—eu-ptychopariid type; B—steno-ptychopariid type; C—asaphid type; D—levisellid type. *r*—rostral shield; *m*—median suture.

## Fam. *Celmidae* n. fam.

DIAGNOSIS.—Small, apparently opisthoparian trilobites. Cephalon comparatively large, surrounded by a distinct convex border. Glabella slightly narrowing anteriorly, with two to three pairs of lateral glabellar furrows. L1 comparatively long and well-defined. Occipital furrow present. Rostral shield short (sag.) and narrow (tr.), trapezoidal. Hypostoma with rounded posterior margin, with small pointed posterior wings, and apparently narrow (tr.) and triangular anterior wings. Posterior lobe of the hypostoma well-defined, fairly convex. 12 thoracic segments in the type genus; the width (tr.) of the segments decreases considerably in posterior direction. Thoracic pleurae of the ridged type, without pleural furrows and facets. Pygidium very small, trapezoidal, apparently consisting of only one tergite; it has no rachis but two crescent-shaped elevations near the anterior margin. The type genus has a tuberculate ornamentation.

DISCUSSION.—The type genus being so far the only genus referable to this family the above diagnosis largely coincides with that of the genus *Celmus*. As pointed out by FR. SCHMIDT (1907) the genus *Crotalurus* VOLBORTH, 1858 is a junior subjective synonym of *Celmus* ANGELIN, 1854.

In order to solve the question about the taxonomical position of the genus *Celmus* a large number of genera in some way or other similar to it has to be considered. Of some of these genera available material has also been studied. As a result of the comparative examination of the similar genera some additional taxonomical problems arose in which the present writer is not quite in accord with current classification.

In searching after the probable affinities of *Celmus* the following families must be considered on the first hand: *Glaphuridae*, *Dimeropygidae*, *Hystricuridae*, *Catillicephalidae*, and *Cheiruridae*.

Several cranidia and librigenae of *Glaphurus pustulatus* (WALCOTT) were examined by the present writer (coll. H. B. WHITTINGTON 1950 and kindly presented by him to UM). This genus has a facial suture of the levisellid type (ULRICH 1930, p. 43, Pl. 8, fig. 15). The preglabellar field is long, the posterior lateral glabellar lobe bicomposite (L1 + L2). The number of thoracic segments amounts to 10; distinct pleural furrows are present. Pygidium small with a long, broad, and strongly convex rachis composed of a small number of segments. Of *Glaphurina* (cf. ULRICH 1930) only cranidia are known so far. Also in this genus the posterior glabellar lobe is evidently bicomposite (L1 + L2), but there is no preglabellar field, the anterior border of the cephalon being in direct contact with the glabella.

Both *Glaphurus* and *Glaphurina* were originally included in *Telephidae* (ULRICH 1930) but later separated by HUPÉ (1953) as a special family *Glaphuridae*. Having examined material of both *Glaphurus* and *Telephus* the present writer agrees with HUPÉ (1953) in considering the former as belonging to a separate family. In fact the few points of similarity between these genera seem to be only superficial, and there does not seem to be sufficient evidence for a relationship between *Glaphurus* and *Telephidae* + *Komaspididae* to justify even their inclusion into the same superfamily, as suggested by HUPÉ (1953). The eyes in *Glaphurus* are small, fixigenae and preglabellar field broad and of quite different type compared with those in telephids or komaspidids. As the development of these characters certainly is more primitive in *Glaphurus* than in telephids and komaspidids it is improbable that this Chazyan genus should have arisen from the telephid-komaspidid stock which is fully developed already in the Upper Cambrian. Its relationship lies more probably somewhere in the vicinity of catillicephalids and related groups. The reference of *Glaphurina* to *Glaphuridae* is somewhat uncertain at present and cannot be definitely ascertained until other parts of the carapace are known.

The cranidium of *Celmus* exhibits a certain external resemblance to *Glaphurina*. In the later genus, however, the posterior lateral glabellar lobe is bicomposite (L1 + L2) whereas in *Celmus* it is formed by L1 only. The specimens recorded by TJERNVIK (1952) as *Crotalurus* n. sp., and apparently also *Crotalurus? strigatus* WEBER have a bicomposite posterior lateral glabellar lobe, and probably belong to *Glaphuridae*. *Glaphurus* possesses a levisellid type of facial suture, and differs widely from *Celmus* also in other characters. There does not seem, therefore, to exist evidence of any closer relationship between the latter genus and *Glaphuridae*.

There exists a number of opisthoparian genera which possess a stenoptychopariid type of rostral shield resembling that of *Celmus*. The following

genera have to be considered: *Dimeropyge* (cf. WHITTINGTON & EVITT 1954), *Dimeropygiella* (cf. ROSS 1953), *Pseudohystricurus* (cf. ROSS 1953), *Hystricurus* (cf. HINTZE 1953), and *Catillicephala* (cf. RASETTI 1952, 1954).

*Dimeropyge*, *Dimeropygiella*, and *Toernquistia*, together with the new genera *Mesotaphrasis* and *Chomatopyge* were included by WHITTINGTON & EVITT (1954) in the family *Dimeropygidae* HUPÉ, 1953. *Dimeropyge* and *Dimeropygiella* have a rostral shield of the steno-ptychopariid type, and the existence of a similar rostral shield has been suggested also for *Toernquistia* (WHITTINGTON & EVITT 1954, p. 35). *Mesotaphrasis* and *Chomatopyge* have a facial suture of levisellid type. The inclusion of the latter genera in a separate family was considered by WHITTINGTON & EVITT (1954, p. 35) but the similarities with *Dimeropyge*, especially regarding the pygidium, were found by them to outweigh the differences in the development of the facial suture. They pointed out, however, that the inclusion into the same family of genera with such different development of the facial suture is a somewhat unusual course. In the present writer's opinion the genera with a facial suture of levisellid type should be included at least in a separate subfamily. Certainly, several cases are known where the development of the foremost part of the facial suture varies even in very closely related groups. In *Dikelocephalidae*, for instance, forms occur both with a median suture (asaphid type) as well as without it (levisellid type) (ULRICH & RESSER 1930; RASETTI 1952), and this family seems thus to be rather unstable in this respect. In *Dimeropygidae* as defined by WHITTINGTON & EVITT (1954), however, the change from e.g. *Dimeropyge* to *Mesotaphrasis* implies first the loss of the rostral shield, i.e. a probable development from the ptychopariid to the asaphid type of facial suture, and only subsequently the loss of the median suture. In the light of the evidence from other trilobites the present writer considers this difference in the development too large to allow the inclusion of both different types of facial suture in one subfamily, at least as long as an intermediate type of facial suture is unknown. Moreover, there exist also other important differences between *Dimeropyge* and the genera with a facial suture of levisellid type included in *Dimeropygidae*. In *Dimeropyge* the thorax is without pleural furrows; the dorsal side of the thoracic pleura is strongly convex, and narrow anterior and posterior flanges are developed (cf. WHITTINGTON & EVITT 1954, p. 49, Fig. 9; the same construction of the thoracic pleura has been observed by the present writer also on detached thoracic segments of *Dimeropyge parvula* [THORSLUND]). In *Mesotaphrasis* a distinct diagonal pleural furrow is present, the pleurae being rather flat and on the whole similar to those in proetids.

In the present writer's opinion the differences between *Dimeropyge* and *Mesotaphrasis* are important enough to justify their inclusion into separate subfamilies. For this reason the new subfamily *Mesotaphrasinae* is proposed here for *Mesotaphrasis* and related genera (cf. p. 47).

The resemblance between *Toernquistia* and certain hystricurids (*Parahystricurus*, *Pseudohystricurus*, *Hystricurus*) was pointed out by Dr. Ross in a personal communication to WHITTINGTON & EVITT (1954, pp. 35–36). The suggestion was discussed by the latter but the relationship of this genus to hystricurids found to be uncertain at that time. Since then our knowledge of these hystricurid genera has been widened by the papers of ROSS (1953) and HINTZE (1953). HINTZE (1953, p. 164, Pl. VI) described and figured the rostral shield in *Hystricurus*, and ROSS (1953, p. 641, Pl. 63, fig. 17) pointed to the possible existence of a similar rostral shield in *Pseudohystricurus*. In both cases the rostral shield is of the steno-ptychopariid type. In *Hystricurus* the thoracic pleurae possess pleural furrows (ROSS 1951, Pl. 14, fig. 27; HINTZE 1953, Pl. VI, fig. 1 b, 1 c), but the published figures give no quite clear picture of the exact construction of the pleura. The thorax and pygidium of *Toernquistia* (REED 1904, Pl. XII, figs. 6, 7) seem to be rather similar to those of *Hystricurus*, and differ in certain important characters from those of *Dimeropyge*. In the present writer's opinion the known features of *Toernquistia* in fact resemble more those of hystricurids than those of *Dimeropyge*. On the other hand, our present knowledge of both hystricurids and dimeropygids does not exclude the possibility that both groups of genera are very closely related.

*Celmus* differs from the hystricurids and *Dimeropyginae* by the presence of a distinct long L1, different construction of the thoracic pleurae, and the rather different pygidium. The details of the shape of the rostral shield are also different but are probably of minor importance. In the construction of the thoracic pleurae *Dimeropyge* is somewhat similar to *Celmus*, principally by the absence of pleural furrows. In the former genus, however, there is a well developed triangular facet, the doublure is much narrower, and the flanges are only weakly developed. On account of these rather considerable differences *Celmus* cannot be included in either *Hystricuridae* or *Dimeropygidae*.

In the development of the rostral shield the genus *Catillicephala* is very similar to *Celmus*, and also other features, *inter alia* the shape of L1 of some *Catillicephalidae* as defined by RASETTI (1954), show some resemblance to *Celmus*. The construction of the thoracic pleura and the pygidium of the latter genus, as well as some other features, are, however, too different to permit the inclusion of *Celmus* into *Catillicephalidae*. Moreover, the latter family as defined by RASETTI (1954) may not be homogeneous, especially with regard to the fairly great variation in this family as to the development of the ventral cephalic sutures.

FR. SCHMIDT (1907) pointed out that the thoracic pleurae of *Celmus* have the same construction as in most cheirurids, and mainly on this account placed this genus in *Cheiruridae*. Cheirurids are, however, proparian, have a rostral shield of the eu-ptychopariid type, and a differently shaped py-

gidium. In this case the similarity in the construction of the thoracic pleura seems to be due to a convergent development.

Thus by its taxonomically important characters the genus *Celmus* differs clearly from other similar groups. The shape of its rostral shield, the construction of the thoracic pleura, and the peculiar pygidium place it in a rather isolated position among the similar groups, and its relationship remains rather uncertain. For this reason the new family *Celmidae* is erected for the genus *Celmus*.

## Gen. *Celmus* ANGELIN, 1854

Syn. *Crotalurus* VOLBORTH, 1858

TYPE SPECIES (by monotypy).—*Celmus granulatus* ANGELIN, 1854.

This being the only genus known so far of the family the diagnosis of the genus coincides largely with that of the family (cf. p. 38).

### *Celmus granulatus* ANGELIN, 1854

Pl. I, figs. 1–7; text fig. 2 A–D

1854 *Celmus granulatus* n. sp.—ANGELIN, p. 24, Pl. XVII, figs. 8–8 a.
cf. 1858 *Crotalurus barrandei* n. sp.—VOLBORTH, pp. 126–133, Pl. XII, figs. 1–5.
non 1907 *Crotalurus barrandei* VOLBORTH—FR. SCHMIDT, pp. 15–16, Pl. I, figs. 9, 10, 11.
non 1955 *Celmus granulatus* ANGELIN—BOHLIN, p. 115 (= *Celmus* sp. indet.).

LECTOTYPE (designated herein).—A carapace without pygidium RM no. Ar. 17989, one of the cotypes of ANGELIN (1854), and used by him in the preparation of the reconstruction on Pl. XVII, fig. 8. Figured in the present paper on Pl. I, figs. 1–3.

TYPE LOCALITY.—Skarpåsen, Östergötland.

TYPE STRATUM.—Lower Ordovician, probably *Expansus* limestone.

DIAGNOSIS.—No proper diagnosis can be given as long as only the type species is sufficiently well known.

MATERIAL.—Östergötland—2 enrolled carapaces without pygidium (cotypes); Närke—1 carapace, 10 cranidia, 10 librigenae, 4 hypostomata, 4 incomplete thoraces, 3 pygidia.

DESCRIPTION.—Carapace broadest at cephalon and narrowest at pygidium. The width of the pygidium is slightly less than that of the frontal lobe of the glabella.

Glabella more or less rectangular in outline, slightly narrowing forwards, greatest width at L1, the anterior margin of the frontal lobe being only slightly convex. In dorsal view the length of the glabella (excl. the occipital ring) about equal to its greatest width. In lateral view the foremost part of the frontal lobe is steeply inclined in relation to the hindmost part of the glabella and is concealed in strictly dorsal view (cf. Pl. I, figs. 1 and 3).

S1 rather strongly developed, deepest in its middle portion, becoming shallower in posterior as well as antero-lateral direction. In posterior direction S1 becomes almost obsolete before reaching the occipital furrow. L1 thus fairly well defined. S2 short, shallow, and on some specimens rather indistinct. The distance between the foremost end of S1 and S2 slightly larger than the length (sag.) of L1. On well preserved specimens an indication of S3 can be traced in front of S2 and very close to it. No anterior pit has been observed. Occipital ring well developed, resembling the foremost rings of the thoracic rachis, and only slightly longer (sag.) than these. Its width (tr.) about equal to the width of the glabella at S3. Occipital furrow moderately broad, deep, widening at the junction with the dorsal furrow. Dorsal furrows of the cephalon well defined, moderately deep.

Fixigenae rather narrow. Eyes comparatively small, situated near the glabella, and rather far forwards. The distance between the posterior end of the eye and the posterior margin of the cranidium slightly larger than the shortest distance between S1. Visual surface rather high, strongly convex. In spite of the relatively good state of preservation of the eye in one specimen no trace of lenses could be observed. Palpebral lobe narrow; no palbebral furrow.

Librigenae rather feebly convex, sloping almost vertically in anterior view. In dorsal view the distal parts of the librigenae are concealed below their proximal parts. External margin of the librigenae broadly and evenly rounded. The genae are surrounded by a moderately wide, slightly convex border which is widest laterally. The border furrow is well-defined, fairly narrow and deep on the posterior part of the fixigena, shallower on the librigena. On the anterior part of the fixigenae the border furrow becomes almost obsolete and is visible as a faint depression which reaches the preglabellar furrow. In front of the glabella the border is rather flattened, and as it is separated from the frontal lobe by the preglabellar furrow only, no preglabellar field can be distinguished in this species.

Facial suture evidently opisthoparian, anterior branch more or less evenly curved, nearly parallel to the dorsal and preglabellar furrows up to the rostral shield. The connecting suture short, straight, and almost sagitally directed. Rostral suture likewise straight, and comparatively short. Rostral shield rather strongly convex, quadrangular, about $2^1/_2$ times broader than long, with a convex distal margin. Posterior branch of the facial suture more or less straight, running in postero-lateral direction. The postero-medial corner of the librigena protrudes slightly, and forms a short posteriorly directed hump at the posterior margin of the cephalon. Due to surface corrosion this hump is not clearly visible on the specimens photographed but its general shape on some other specimens is similar to that figured by Fr. Schmidt (1907, Pl. I, fig. 11). Provided that this hump corresponds to a vestigial genal spine as the present writer is inclined to suppose, the opisthoparian character of the facial suture is obvious.

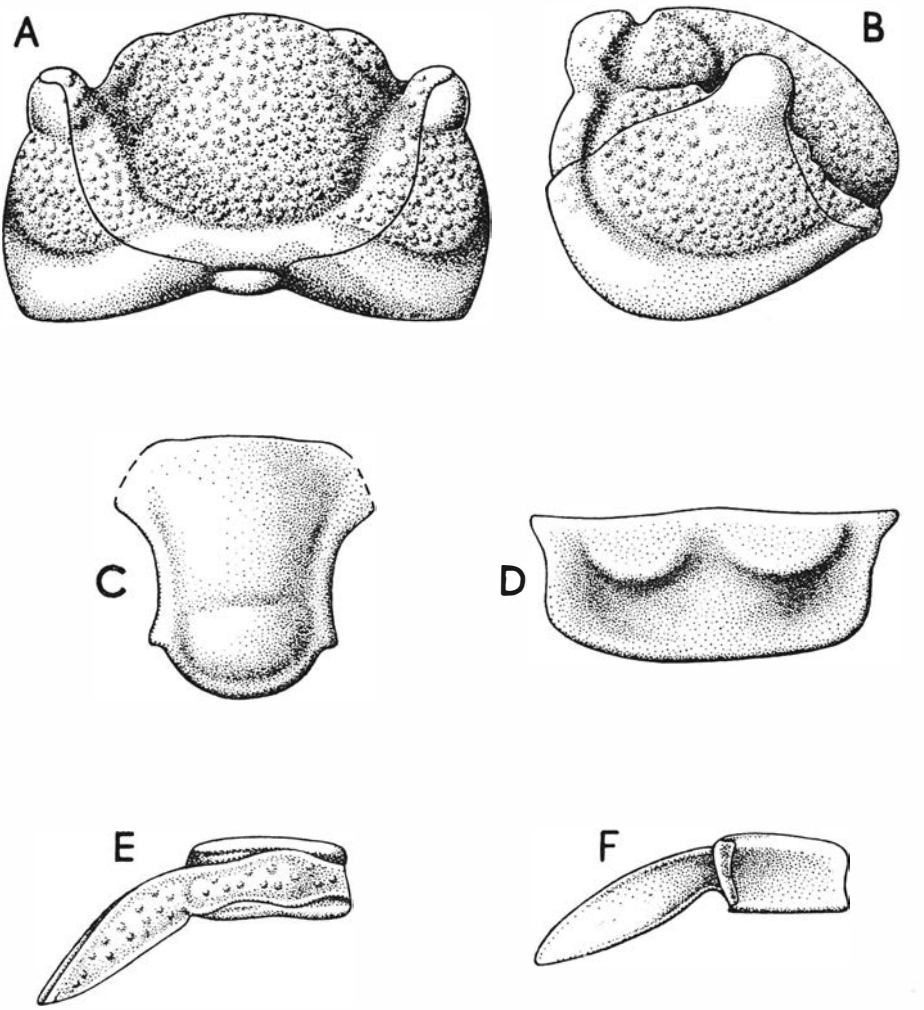


Fig. 2. A–D—*Celmus granulatus* ANG. A—anterior view of the cephalon reconstructed after the specimen RM Ar. 17990 (cf. Pl. I, fig. 5); B—lateral view of the cephalon reconstructed after the same specimen (cf. Pl. I, fig. 4); C—hypostoma after a specimen from Närke belonging to S.G.U., × 20; D—pygidium after the specimen figured on Pl. I, fig. 7 (S.G.U.), × 20. E–F—*Celmus barrandei* VOLB. A thoracic pleura in dorsal and ventral views after VOLBORTH 1858, Pl. XII, fig. 5 a and 5 c.

The ornamentation of the glabella and of the genae consists of rather coarse, closely spaced tubercles of more or less uniform size. The diameter of the tubercles is, as a rule, larger than the distance between them, and often twice as large. In front of the facial suture the anterior border bears closely spaced faint concentric striae which seem to continue even on the rostral shield.

All examined hypostomata are somewhat incomplete and strongly corroded.

Posterior margin of the hypostoma evenly rounded, anterior lobe rather flattened, posterior lobe moderately convex. At the boundary between these lobes there exists a rather distinct, shallow middle furrow (cf. fig. 2 C). The hypostoma is bordered posteriorly and laterally by a narrow border with up-turned outer edge. No maculae were observed. The doublure projects postero–laterally in a pair of pointed posterior wings. Anterior wings apparently narrow, more or less triangular. Details of the hypostomal attachment unknown.

Thorax composed of 12 segments. Rachis about as broad (tr.) as the pleural region, except for the hindmost segments where the rachis is slightly wider than the corresponding pleura. Rachis strongly convex, considerably tapering backwards, the width of the last rachial ring being only about half that of the foremost ring. Articulating half-ring about as long (med.) as the rachial ring and separated from it by a fairly deep articulating furrow. The latter widens at the junction with the moderately deep dorsal furrow.

Inner part of pleura slightly convex, lying more or less horizontal in anterior view. Fulcrum broadly rounded, outer part of pleura strongly bent down. No pleural furrows. The construction of the pleurae has been exhaustively described and well illustrated already by VOLBORTH (1858, p. 131). They are ridged and of the "*type à bourrelet*" according to the terminology of BARRANDE (1852, Pl. 6). On the inner part of the pleura the anterior and posterior flanges are distinctly defined and moderately broad, bordering the central, strongly convex part of the pleura. The outer part of the pleura lacks the flanges and is shaped as a direct continuation of the convex central part of the inner pleura (cf. fig. 2 E). The flanges end abruptly at the fulcrum where the whole pleura shows a distinct constriction similar to that in certain cheirurids. The ventral side of the outer part of the pleura is covered with the doublure up to the fulcrum (cf. fig. 2 F) where the more or less straight inner margin of the doublure protrudes slightly in ventral direction. No facet is developed.

The thorax possesses the same type of ornamentation as the cephalon.

Pygidium small, trapezoidal (cf. fig. 2 D; Pl. I, fig. 7). Width about $2\,^1/_3$–$2\,^1/_2$ greater than the length. No trace of rachis. Near the anterior margin of the pygidium the surface is elevated to form two crescent-shaped elevations, one on each side of the median line. The surface of the elevations slopes more or less evenly forwards and rather steeply backwards. Postero-laterally of each elevation the surface of the pygidium is conspicuously depressed. The pygidium is surrounded by a narrow rounded border or edge lying only slightly higher than the inner surface of the pygidium. Distally from the border the surface of the pygidium is steeply sloping, and protrudes into a short triangular wing at the antero-lateral corner of the pygidium. Upon the surface of the pygidium no ornamentation has been observed.

DIMENSIONS of the specimen RM no. Ar. 17990, figured on Pl. I, figs. 4–5. Measurements in mm.

| | |
|---|---|
| 1. Length of the cephalon (distance between the posterior margin of the occipital ring and the rostral suture) | 6.1 |
| 2. Width of the cephalon (greatest distance between the lateral ends of the librigenae) | 7.8 |
| 3. Length of the glabella | 4.7 |
| 4. Width of the occipital ring | 3.7 |
| 5. Length of the eye | 1.5 |
| 6. Height of the eye | 1.3 |
| 7. Distance between the posterior end of the eye and the posterior margin of the cephalon | 2.3 |
| 8. Width of the rachis of 1st thoracic segment | 3.7 |
| 9. Width of the rachis of 6th thoracic segment | 3.2 |
| 10. Width of the pleural region of 6th thoracic segment | 2.9 |
| 11. Width of the rachis of 12th thoracic segment | 1.9 |
| 12. Width of the pleural region of 12th thoracic segment | 1.4 |

DISCUSSSION.—*Celmus granulatus* ANG. closely resembles *Crotalurus barrandei* VOLB. as described and illustrated by VOLBORTH (1858). Small differences in the shape of the pygidium and in some other minor details may be due to slight inaccurateness of the drawings in VOLBORTH. To judge from VOLBORTH's figures the ornamentation of *Cr. barrandei* appears to be practically identical with that of the specimens described. The specimens of *Cr. barrandei* from the VOLBORTH's collection figured by FR. SCHMIDT (1907, Pl. I, figs. 9–10) differ, however, in several important respects from *Celmus granulatus* as well as from the VOLBORTH's figures (1858, Pl. VII, fig. 1–3). The eyes are *inter alia* much lower, the librigenae less steeply inclined, and the ornamentation consists of much finer and more scattered tubercles. These specimens are, therefore, certainly not conspecific with *Celmus granulatus*. It is possible that VOLBORTH's collection includes two different species of *Celmus* one described by him (1858) and probably identical with *Celmus granulatus*, and the other figured by FR. SCHMIDT (1907). But the drawings in VOLBORTH (1858) may also be incorrect in the above respects, and may actually represent the species figured by FR. SCHMIDT (1907). In this case *Celmus barrandei* VOLB. would be clearly different from *C. granulatus*. This question cannot be solved without a study of VOLBORTH's collection. There is, however, no doubt whatsoever that, as pointed out already by FR. SCHMIDT (1907), *Celmus* and *Crotalurus* are subjective synonyms.

The specimens from the *Gigas* limestone of Öland determined by BOHLIN (1955) as *Celmus* aff. *granulatus* are not conspecific with *C. granulatus*. They possess *inter alia* much smaller tubercles (cf. Pl. I, fig. 9). The size of the tubercles on these specimens is on the whole equal to that in *Celmus barrandei* as figured by FR. SCHMIDT (1907, Pl. I, figs. 9, 10) but they are

apparently more closely spaced. Of this species only cranidia are known so far, and more material must be studied before the species can be defined.

OCCURRENCE.—The exact stratigraphical horizon is unknown for any specimen of *Celmus granulatus* examined but all probably derive from the *Expansus* limestone. The cotypes of ANGELIN (1854) were collected at Skarpåsen, Östergötland. Numerous specimens (deposited in SGU) have been collected by J. G. ANDERSSON, in all probability from Närke, but the exact locality is unknown.

## Fam. *Dimeropygidae* HUPÉ, 1953
## Subfam. *Mesotaphrasinae* nov.

DIAGNOSIS.—Small opisthoparian trilobites with facial suture of levisellid type. Glabella narrowing anteriorly, two or three pairs of lateral glabellar furrows may be present. L1, if defined, relatively long. An occipital furrow present. (Hypostoma and the number of thoracic segments unknown.) Thoracic pleurae usually with a distinct pleural furrow. Pygidium small, with a well defined rachis composed of few rachial rings.

DISCUSSION.—In addition to *Mesotaphrasis* WHITTINGTON & EVITT, 1954, and *Chomatopyge* WHITTINGTON & EVITT, 1954, also *Clelandia* COSSMAN, 1902, shows the essential characters of the subfamily including the levisellid type of facial suture (cf. e.g. CLELAND 1900, HINTZE 1953). Without a first-hand knowledge of the latter genus it is, however, difficult to decide if these characters indicate a real relationship. Furthermore, attention should be paid to the general similarity between the cranidia of *Mesotaphrasis* and *Panarchaeogonus* ÖPIK, 1937. Inasmuch as the ventral cephalic sutures, thorax, and pygidium in the latter genus are unknown, its taxonomic position cannot be ascertained; neither is there, on the other hand, at present any evidence which would exclude the possibility of its belonging to *Mesotaphrasinae*.

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## Plate I

All specimens whitened with ammonium chloride. Photographed by Mr. N. HJORTH, slightly retouched by Mr. E. STÅHL.

### *Celmus granulatus* ANGELIN, 1854

1–3. LECTOTYPE.—One of the cotypes of ANGELIN (1854). RM no. Ar. 17989. ×6. Östergötland, Skarpåsen. Probably *Expansus* limestone.

4–5. The second of the cotypes of ANGELIN (1854). RM no. Ar. 17990. ×6. Same locality and horizon.

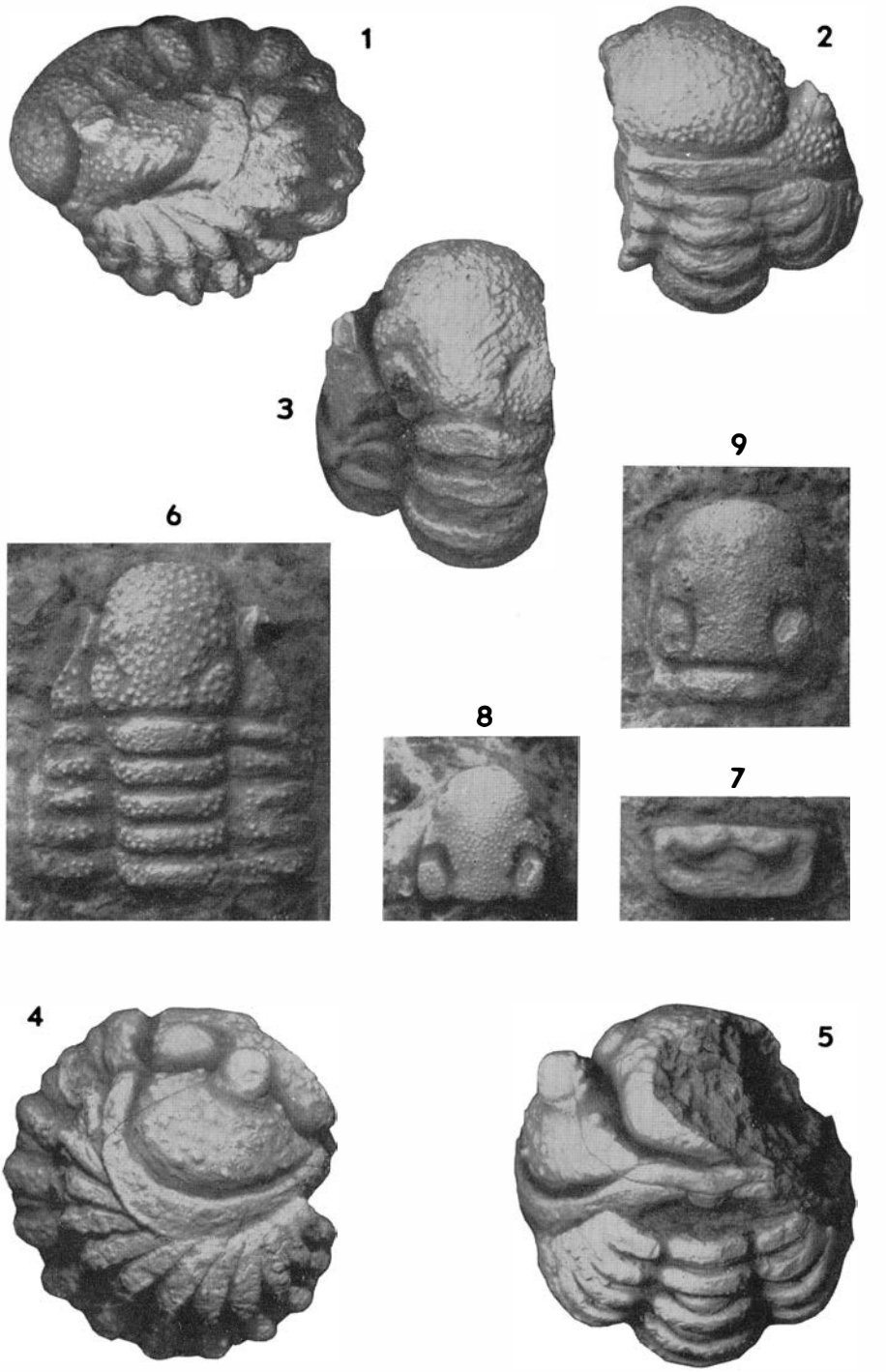
6. Cranidium and 4 foremost thoracic segments in dorsal view. SGU. ×6. Närke. Probably *Expansus* limestone. Coll. J. G. ANDERSSON.

7. Pygidium in dorsal view. SGU. ×10. The same collection as the fig. 6.

### *Celmus* aff. *granulatus* ANGELIN, 1854

8. Internal mold of a glabella in dorsal view. RM no. Ar. 22985. ×6. Öland, Gässlunda. Red "*Raniceps*" limestone.

9. Glabella in dorsal view. UM no. Öl. 131. ×6. Öland, exposure in a ditch immediately N of Långalvaret, parish of Böda (locality L in BOHLIN 1955, p. 128). *Gigas* limestone. Coll. JAANUSSON & MARTNA 1952.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